16420 - Transient LMXBs in Globular Clusters

Cycle: 28, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) TERZAN6-TRANSIENT	ACS/WFC	2	20-Aug-2021 11:00:31.0	yes
02	(2) GCTRANSIENT2	ACS/WFC	2	20-Aug-2021 11:00:33.0	yes

4 Total Orbits Used

ABSTRACT

Since the discovery of globular cluster LMXBs in the 1970s, it was long assumed there was only one luminous LMXB per cluster. Deep Chandra observations of globular clusters have revealed that they contain numerous quiescent LMXB systems, any of which could go into outburst. Our past Chandra programs have shown that globular clusters can indeed harbor multiple transients and that more quiescent LMXBs are hiding under the sensitivity limits of even relatively deep Chandra exposures. Here we propose to continue our Chandra program to precisely localize new transients in globular clusters, with the aim of gaining better insight into globular cluster LMXB populations. As part of this effort we further request HST observations to identify the optical counterparts of these transients.

OBSERVING DESCRIPTION

NOTE added after the trigger: we have triggered this HST observation on an X-ray transient that has been detected in the globular cluster Terzan 6 by Swift. We have adjusted the target coordinates accordingly. In each orbit (one for F606W exposures, one for F814W exposures) we have fitted one short (30s) and four longer (about 475 s) exposures.

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The goal of this joint Chandra/HST Target-of-Opportunity (ToO) proposal is to measure accurate coordinates of the next two X-ray transients in a globular cluster with Chandra, and to use HST subsequently to look for their optical counterparts inside the Chandra positional error circles. The Chandra error circle is large enough (about 0.6" radius) that it likely contains multiple globular-cluster stars. Comparison of the photometry that is extracted from the observations requested here (to be taken about 25 days after triggering the proposal) with photometry from archival HST data reveals highly variable objects in the error circle, and hence the identity of the true counterpart. Our choice for the ACS/WFC is driven by the existence of a large body of archival globular-cluster images taken with this camera.

We have been allocated time to do Chandra/HST follow-up for two X-ray transients. For the HST component we were granted 4 HST orbits in total. Our program is made up of two completely independent but identical visits of two orbits each. The first orbit in a visit is spent on observations in the F606W band, and the second orbit on observations in the F814W band. The structure of these two orbits is the same.

We start an orbit with a short exposure (30s) to obtain photometry of relatively bright stars that are saturated in the longer exposures. The short exposure is followed by 4 to 5 longer (about 340s) exposures; the exact number of exposures and the exposure times depend of the duration of the orbit and will be determined once the target coordinates are known. We aim for a minimum of 4 long exposures so that they can be arranged in an ACS-DITHER-BOX pattern. In this Phase II file we have assumed that 5 long exposures can be accommodated. The first long exposure is to be taken at the target coordinates. The remaining 4 long exposures are put in a Pattern container that is coupled to the default ACS-DITHER-BOX pattern with center=yes. As a result these 4 exposures will surround the first long exposure. To elevate the background levels, we have added a post-flash of 25e- to each short (=30s) exposure.

Given the ToO nature of our program, our targets have been defined as two generic targets with unknown coordinates. Once the coordinates are

known, we can fine-tune the observational setup, such as the exposure times and number of exposures, as well as the detailed placement of the target (i.e. the Chandra error circle) on the ACS/WFC detectors.

** Impact of reduced-gyro operations

The primary impact of reduced-gyro operations is a reduction of HST's field of regard. Therefore, we expect that the main effect on our program is a possible reduced likelihood of responding to our Target-of-Opportunity trigger within the requested time frame of 25 days.

Visit

Proposal 16420, Visit-Terzan6-transient (01), implementation Fri Aug 20 15:00:34 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT 112D TO 112 D; ON HOLD ; TOO RESPONSE TIME 25.0D

On Hold Comments: Target of Opportunity

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.262 Line Spacing=0.192	Coordinate Frame=POS-TARG Pattern Orientation=18.39 Angle Between Sides=68.14 Center Pattern=true		(2), (4)

Fixed Targets

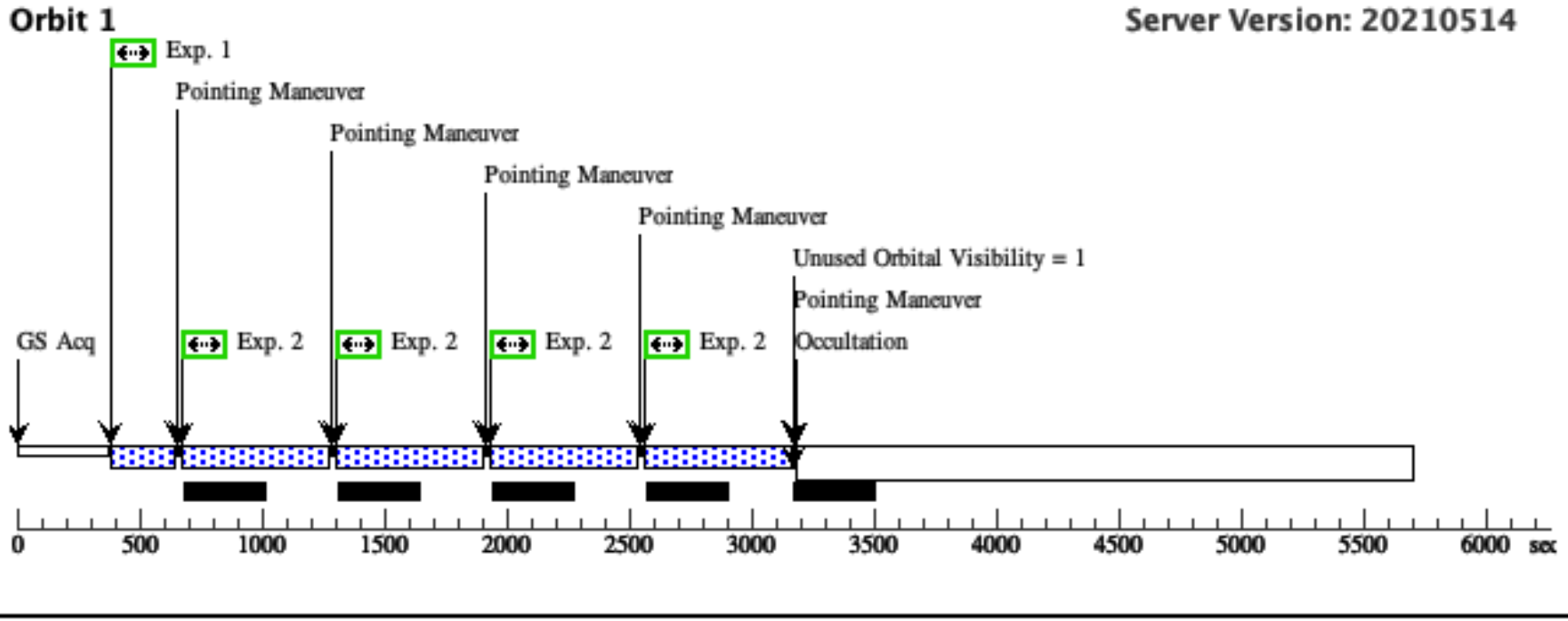
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TERZAN6-TRANSIENT	RA: 17 50 46.7000 (267.6945833d) Dec: -31 16 35.00 (-31.27639d) Equinox: J2000		V=21.0	Reference Frame: ICRS

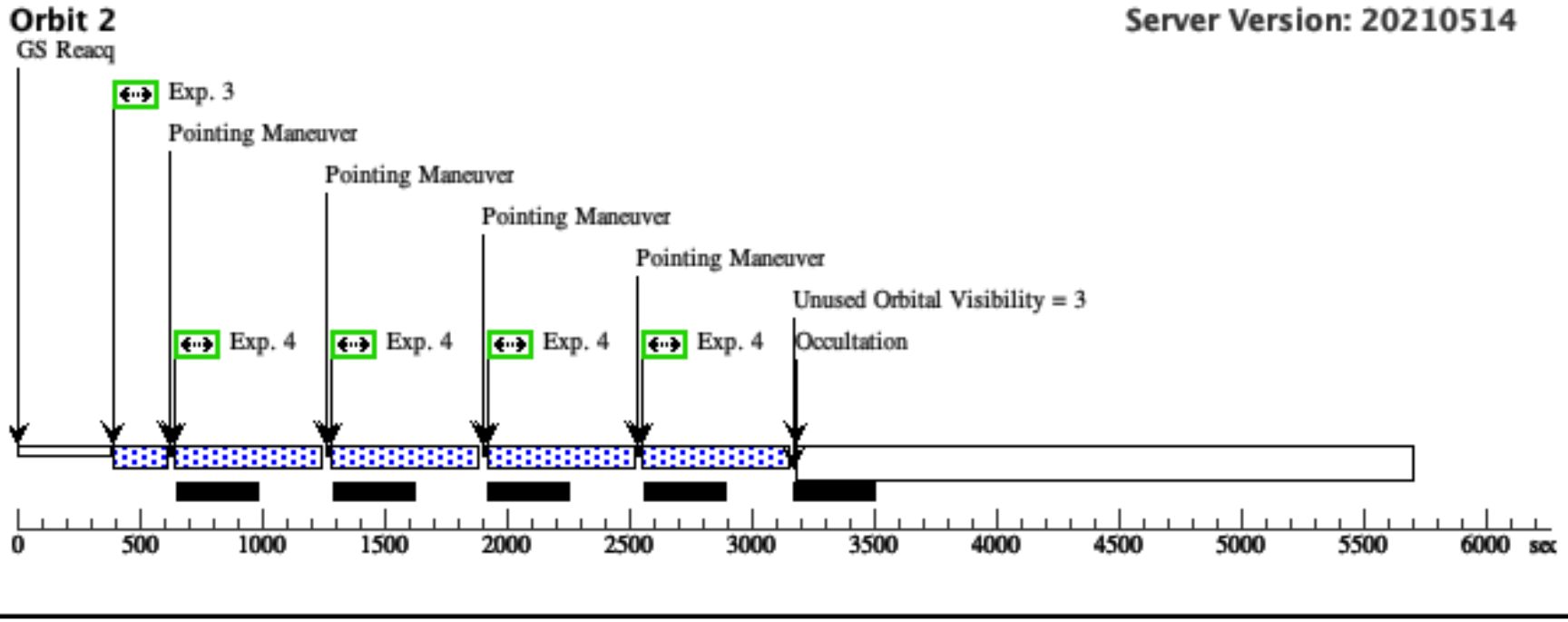
Comments: Our target is a to-be-identified star in the globular cluster Terzan 6. The counterpart that we aim to identify is expected to have a magnitude in F606W m(F606W) > 21.
Category=STELLAR CLUSTER
Description=[GLOBULAR CLUSTER]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	short-I	(1) TERZAN6-TRANSIENT	ACS/WFC, ACCUM, WFC1	F814W	FLASH=25			30 Secs (30 Secs)	
								[==>]	***[1]***
2	long-I-dither box	(1) TERZAN6-TRANSIENT	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 2-2 in Visit-Terzan6-transient (01) (1)	473 Secs (1892 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
3	short-V	(1) TERZAN6-TRANSIENT	ACS/WFC, ACCUM, WFC1	F606W	FLASH=25			30 Secs (30 Secs)	
								[==>]	***[2]***
4	long-V-dithe rbox	(1) TERZAN6-TRANSIENT	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 4-4 in Visit-Terzan6-transient (01) (1)	480 Secs (1920 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***

Orbit Structure





Visit

Proposal 16420, Visit-Transient2 (02), implementation Fri Aug 20 15:00:34 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ON HOLD ; TOO RESPONSE TIME 25.0D

On Hold Comments: Target of Opportunity

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.262 Line Spacing=0.192	Coordinate Frame=POS-TARG Pattern Orientation=18.39 Angle Between Sides=68.14 Center Pattern=true		(3), (6)

Generic Targets

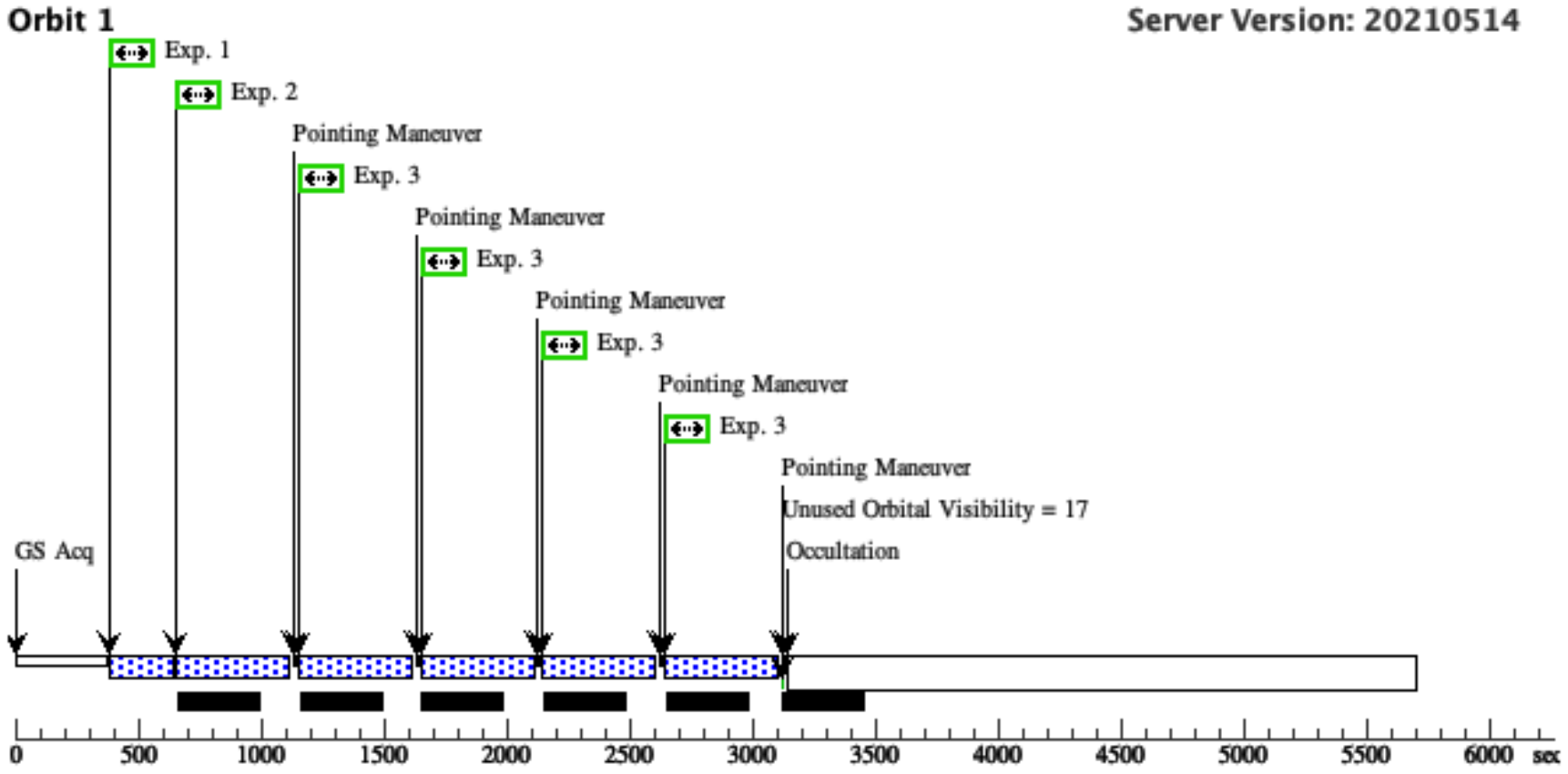
#	Name	Criteria	Description
(2)	GCTRANSIENT2	second trigger of globular-cluster X-ray transient program	X-RAY TRANSIENT

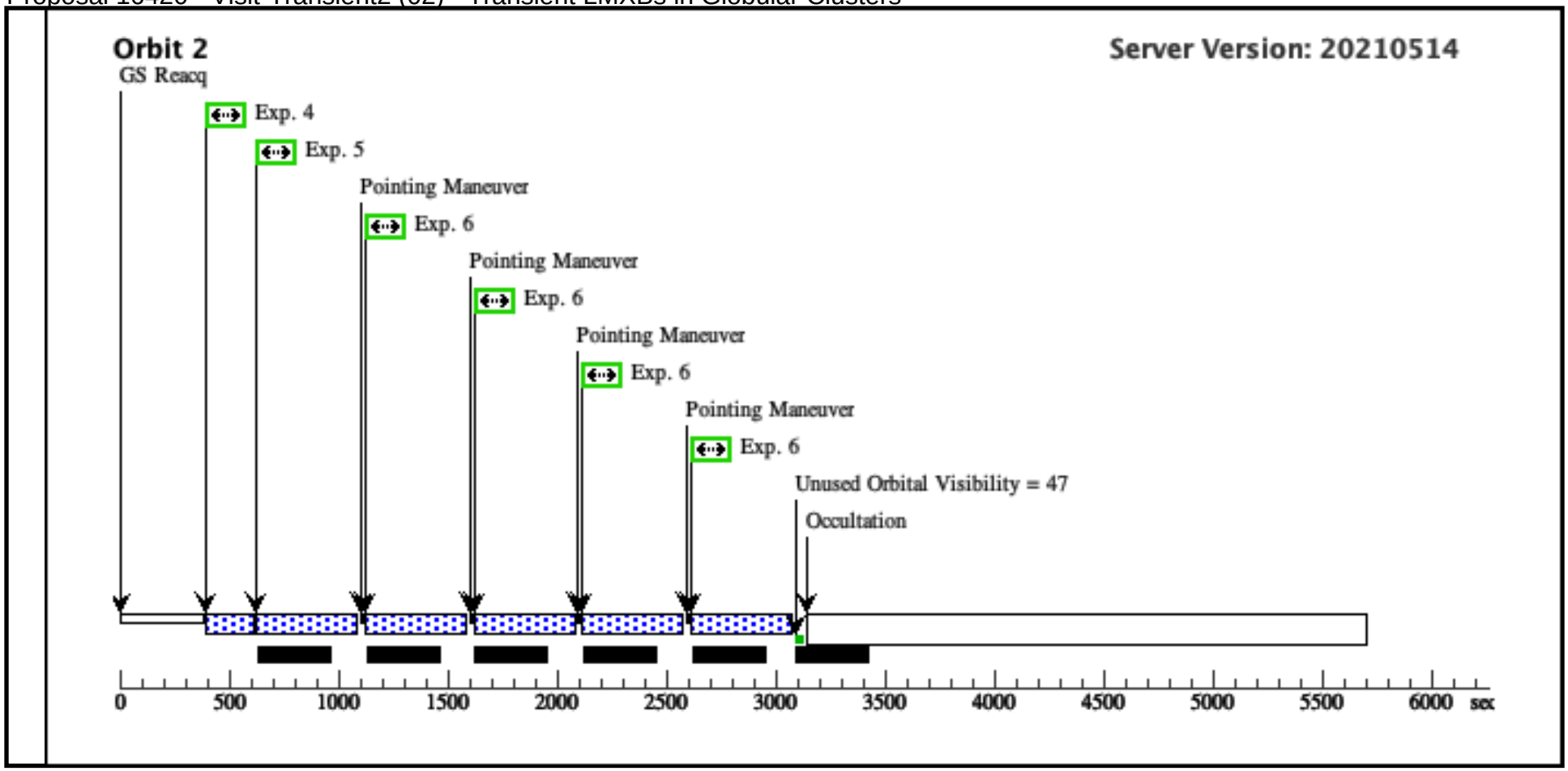
Comments: next X-ray transient discovered in a Galactic globular cluster, whose position can only be accurately determined with Chandra

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	short-V	(2) GCTRANSIENT2	ACS/WFC, ACCUM, WFC1	F606W	FLASH=25			30 Secs (30 Secs)	
								[==>]	***[1]***
2	long-V-centerbox	(2) GCTRANSIENT2	ACS/WFC, ACCUM, WFC1	F606W				340 Secs (340 Secs)	
								[==>]	***[1]***
3	long-V-ditherbox	(2) GCTRANSIENT2	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 3-3 in Visit-Transient2 (02) (1)	340 Secs (1360 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
4	short-I	(2) GCTRANSIENT2	ACS/WFC, ACCUM, WFC1	F814W	FLASH=25			30 Secs (30 Secs)	
								[==>]	***[2]***
5	long-I-centerbox	(2) GCTRANSIENT2	ACS/WFC, ACCUM, WFC1	F814W				340 Secs (340 Secs)	
								[==>]	***[2]***
6	long-I-dither box	(2) GCTRANSIENT2	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 6-6 in Visit-Transient2 (02) (1)	340 Secs (1360 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***

Orbit Structure

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GS Reacq
Exp. 4
Exp. 5
Pointing Maneuver
Exp. 6
Pointing Maneuver
Exp. 6
Pointing Maneuver
Exp. 6
Pointing Maneuver
Exp. 6
Unused Orbital Visibility = 47
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec